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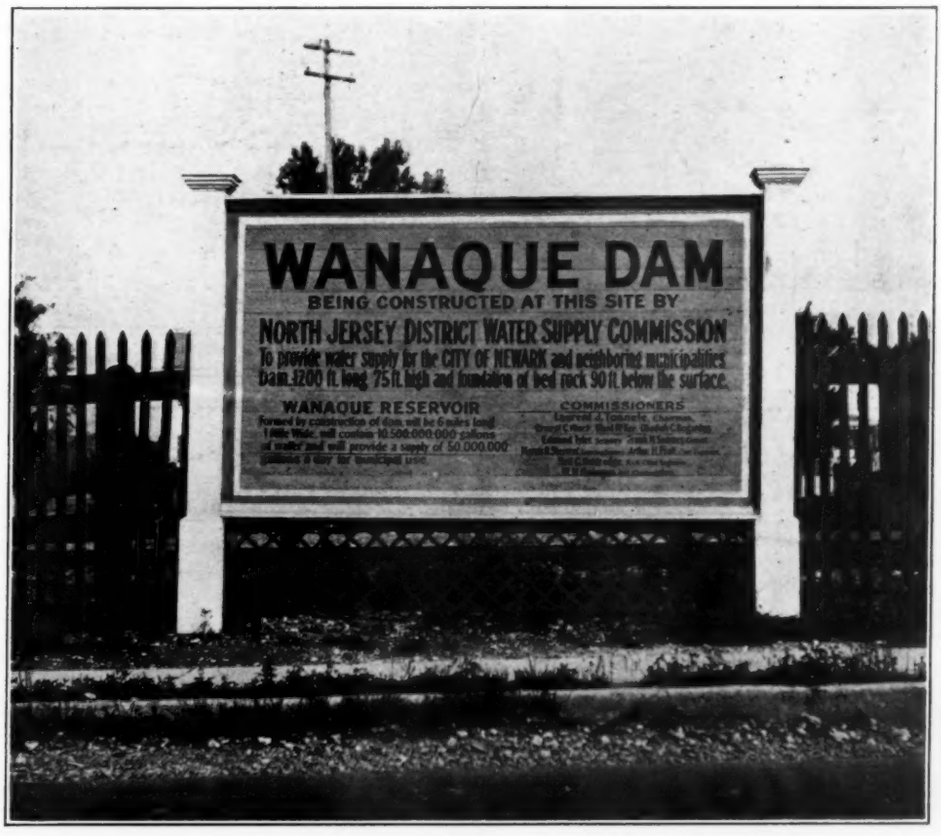
WANAQUE DAM
BEING CONSTRUCTED AT THIS SITE BY
NORTH JERSEY DISTRICT WATER SUPPLY COMMISSION
To provide water supply for the CITY OF NEWARK and neighboring municipalities
Dam 2200 ft. long 75 ft. high and foundations of hard rock 90 ft. below the surface.
WANAQUE RESERVOIR
COMMISSIONERS

HOW THE NORTH JERSEY DISTRICT WATER SUPPLY COMMISSION INFORMS THE PUBLIC WHAT IS BEING DONE BEYOND THE FENCE.
This sign is on the west side of an intensely traveled turnpike.

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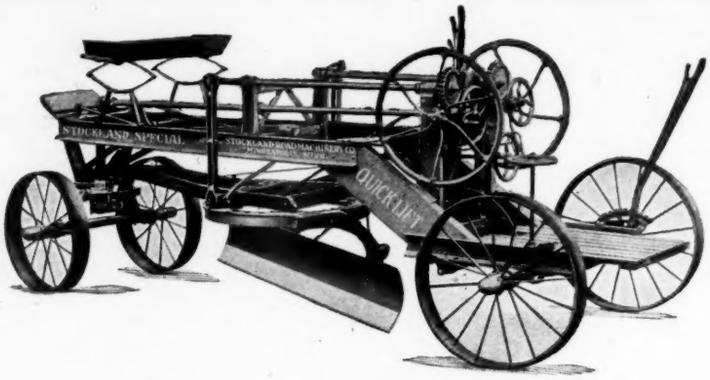
AUGUST 27, 1921



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Road builders make a conservative estimate that an average of 30 such stops are necessary each day and that the operation of raising and lowering the blade by hand-wheels consumes 3½ minutes each stop.

Thirty such stops averaging 3½ minutes each, amounts to 1¾ hours, or 17 per cent of a 10-hour working day which is lost while the operator is tugging at the hand-wheels.

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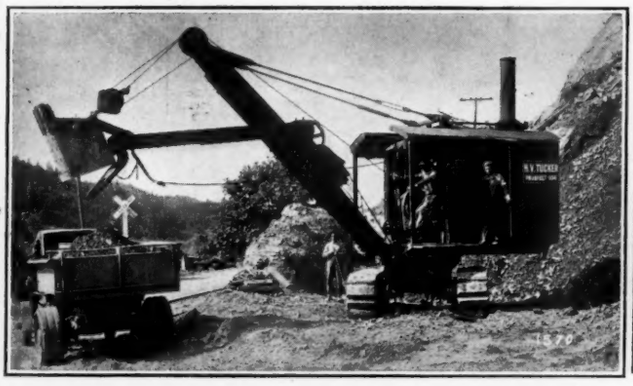
Stockland Road Machinery Co., **Minneapolis, Minnesota**



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PUBLIC WORKS.

CITY COUNTY STATE

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Vol. 51 AUGUST 27, 1921 No. 9

Constructing the Wanaque Dam

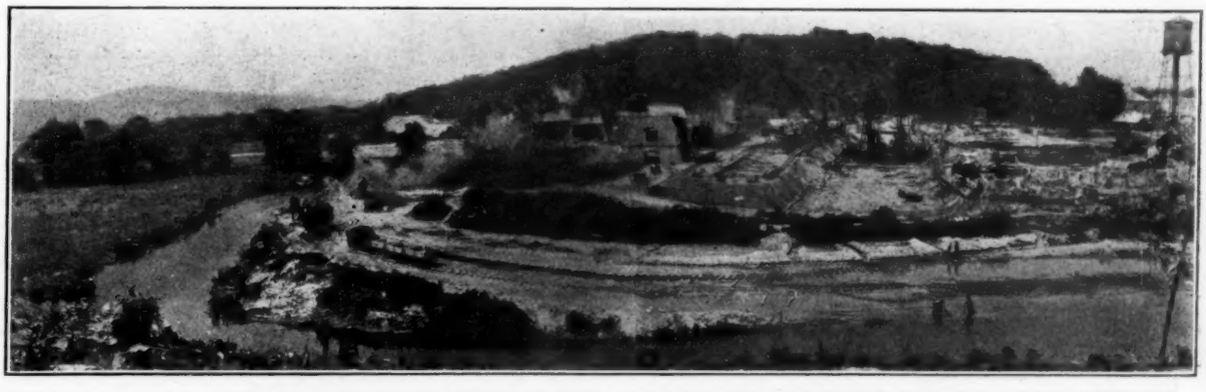
The North Jersey District Water Supply Commission is building, near the northern end of New Jersey, an earthen dam with concrete core wall about a thousand feet long and 170 feet maximum height. Spliced steel sheet piles eighty feet long are being driven through compact gravel. The plant is unusually complete.

The general plan of the Wanaque dam, which is being built by the North Jersey District Water Supply Commission for furnishing water to Newark and other New Jersey communities, was described in our issue of April 17, 1920, and the contract made with W. H. Gahagan, Inc., for constructing the first part of this work was described in the issue of December 4. The contract is a form of cost plus the contractors' commission, increasing as the cost decreases below a fixed total or base price, which is about $1,125,000. The present contract is chiefly for the core or cut-off wall, which is being built across the valley in advance of the construction of the earthen embankment, of which the dam will be composed.

This concrete wall will be carried down to bedrock across the valley with depths ranging up to about 100 feet, or a total height of 170 feet. The total length of the core wall is between 900 feet and 1,000 feet. The wall will be 12 feet thick up to the surface of the ground, above which there will be a batter of 20 on 1 on each face. Along the line of the core wall, the ground surface has an elevation of approximately 225 feet above mean sea level. At the north end, the last 100 feet rise sharply to the finished grade of the dam. On the south end, the wall ends in a gate house on the side of the steep hill. The Wanaque river crosses the line of the core wall near its south end. The wall will be completed nearly to the river, the stream later being diverted into another channel and the core wall completed.

THE CORE WALL TRENCH

Before beginning the excavation of the core wall trench proper, a trench with sides sloping one to one and a bottom width of 60 feet was excavated by steam shovel along the line of the core wall, its bottom being brought to a uniform elevation of 212, or 13 feet below the general ground level. Along the center of this channel is dug the core wall trench 20 feet wide. The construction of this trench is at present the most interesting feature. Steel sheet piling is being driven along each side of the trench down to solid



GENERAL VIEW OF DAM SITE, FROM HILL SOUTH END OF DAM.
Camera is on centre line of core wall. Wanaque river in foreground. At left background, track (on embankment) leading to gravel pit. In foreground, paper sludge being removed by steam shovel and dump cars. At extreme right, remains of paper mill cellar, and old water tank, put to use by contractor.

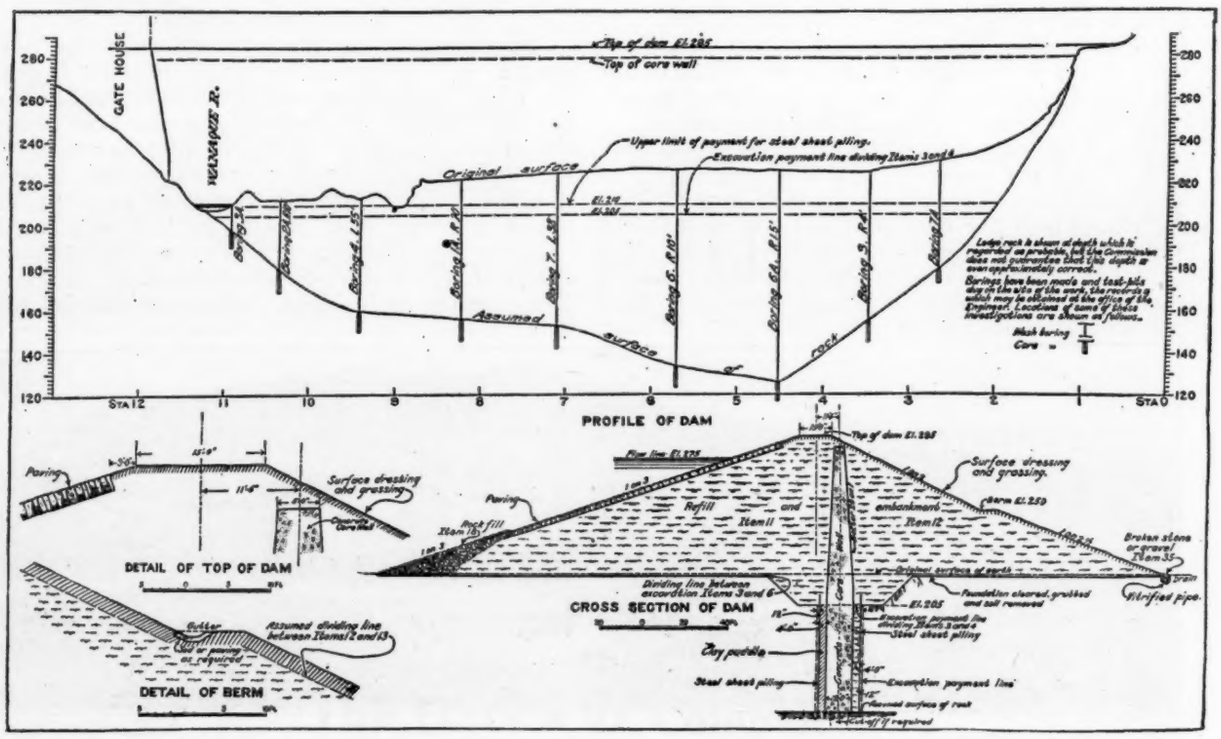
rock, the excavation between the lines of sheet piling following along behind but practically no excavation has been performed as sufficient sheeting on both sides of that point has been driven to refusal on bedrock. The most noteworthy feature of this is the depth to which the sheeting is being driven, a maximum of 80 feet of continuous steel sheet pile having been driven at the deepest portion of the rock valley.

The site of the reservoir, and the valley for a considerable distance below, was formerly the bottom of a lake and was filled in with sedimentary deposits. The site of the dam is near the upper end of this lake and the deposits here are largely of gravel and coarse sand, with a little fine sand near the surface but no clay except talus washings from the hills, the clay having all been deposited further down the valley. The gravel runs from very fine material up to stones of 2 to 3 inches and occasionally larger. This makes a very solid material and difficult for driving sheet piling.

The sheet piling used is Lackawanna, 35 pounds to the square foot, and in various lengths from 20 feet up to 50 feet. A depth of 100 feet was reached at a distance of about 250 feet from the north end and the depth is now gradually decreasing. In securing the different depths, piles varying from 20 to 50 feet in length are used, and are spliced for depths exceeding 50 feet. Although the piles are protected by a driving cap, there is more or less battering of the head owing partly to the hard driving required, and in making the splice the battered end where necessary is cut off by means of an oxyacetylene torch. Care is taken to obtain a square end in order that the splice may obtain perfect contact between the two lengths of piling. It is proposed to endeavor to draw the piles in order to salvage them and the splice is therefore made stronger than would otherwise be the case. Each pile has three holes bored on each side of the pile or twelve holes at a joint. The splice is made by placing a steel channel on one side of the pile and a steel plate on the opposite side and bolting the two together through the holes already provided in the sheet piles. This provides a very strong and stiff splice.

The piles are driven by two 5-ton Vulcan steam hammers, one working on each side of the trench. The hammer is supported by a driver with its guides extended so that the sheave is 90 feet above the ground surface. The pile driver is mounted on a platform which is moved backward and forward along the trench by its own power. Piles are driven in sections of about 50 feet. In starting each section, a frame of heavy timber is moved forward, this frame standing about 25 feet high, 50 feet long and 20 feet wide, this being the width of the trench between sheet piling. By means of the pile driver, the sheet piles are then assembled and interlocked against the frame where they are held in position independent of the pile driver. The pile driver then moves backward and forward, driving each of several piles a foot or two, one after the other, in order that, within certain limits of variation, all the piles in a set shall move down together. The chief object of this is to keep the alignment of the piles underground as nearly straight as possible.

As an indication of the difficulty of the driving, in some cases 60 blows of the 5-ton Vulcan ham-


GATE HOUSE
WANAQUE R.
Original surface
Assumed surface of rock
PROFILE OF DAM
DETAIL OF TOP OF DAM
DETAIL OF BERM
CROSS SECTION OF DAM
Surface dressing and grassing
Refill and embankment
Item 12
Item 18
Item 35
Broken stone or gravel
Tile drain
Vitrified pipe
Clay puddle
Steel sheet piling
Foundation cleared, grubbed and soil removed
Excavation payment line
Original surface of earth
Rock fill
Item 13
Item 11
Item 6
Item 3
Item 2
Item 1
Top of dam El. 285
Top of core wall
Upper limit of payment for steel sheet piling.
Excavation payment line dividing Items 3 and 6
Ledge rock is shown at depth which is reported as probable but the Commission does not guarantee that this depth is even approximately correct.
Borings have been made and test-pits dug on the site of the work, the records of which may be obtained at the office of the Engineer. Locations of some of these investigations are shown as follows.
Rock boring
Core
STA 12
STA 0

PROFILE AND CROSS SECTION OF WANAQUE DAM

Shows details of slope protection and core wall. Also location of preliminary exploration rock borings.

mer are required to drive a pile one inch. This is exceptional, however, 3 or 4 blows ordinarily being sufficient to drive one inch, while in some soft spots the pile will go an inch or two inches at a single blow. The hammers operate at a rate of almost exactly 60 blows per minute.

A trial was made of the use of the water jet to aid in driving the sheet piling, but owing to the nature of the material it was found that there was only an occasional slight benefit derived. which showed that the use of the jet would be no economy and could not be relied upon except as a slight aid to the use of the heavy hammer.

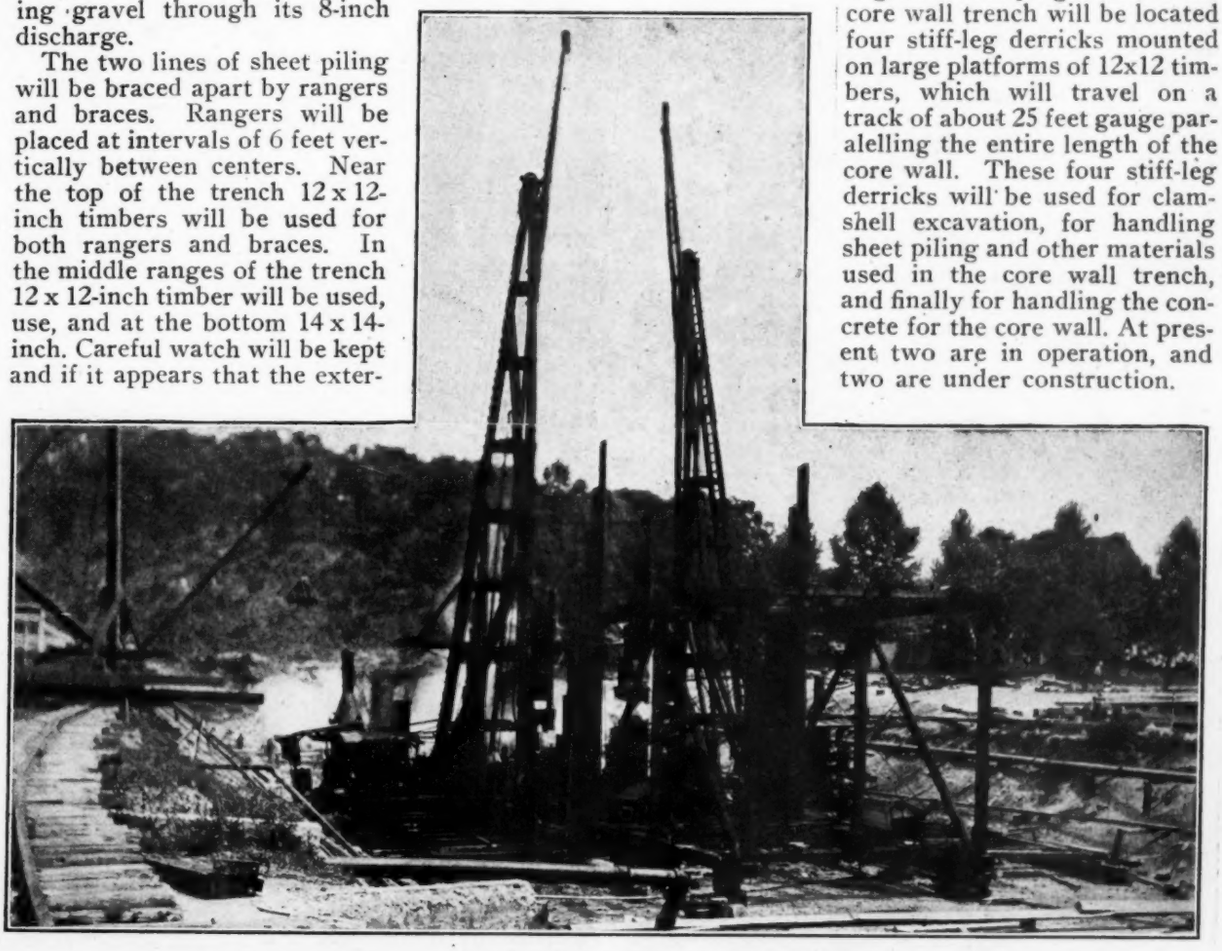
As the piles are driven and the frame and drivers move ahead, the gravel between the two rows of piling is removed with a clam-shell bucket operated by a stiff-leg derrick. Owing to the compact gravel formation in part of the trench, it is difficult for the clam-shell to penetrate and obtain more than one-quarter load at a time. In addition to this, the bottom of the trench has been carried 4 or 5 feet below ground water level and on July 23 a dredge pump was installed with the idea of dredging the remaining depth of the trench and depositing the gravel on the downstream side of the dam. At the time of the visit of the writer to the work, July 26, the pump was just going into action and was delivering gravel through its 8-inch discharge.

The two lines of sheet piling will be braced apart by rangers and braces. Rangers will be placed at intervals of 6 feet vertically between centers. Near the top of the trench 12 x 12-inch timbers will be used for both rangers and braces. In the middle ranges of the trench 12 x 12-inch timber will be used, use, and at the bottom 14 x 14-inch. Careful watch will be kept and if it appears that the external pressure is becoming greater than the bracing can support, intermediate lines of rangers and braces will be introduced as will be done should the sheet piling bulge between lines of rangers.

When the trench has been sheeted and excavated to bedrock, forms will be set up for the concrete core wall, which will be 12 feet thick and will in general be 4 feet inside of the sheet piling. As the core wall is completed, the space between it and the sheet piling will be filled, a clay puddle about one clay to one gravel being used on the upstream side and good soil well compacted on the downstream side. After the concrete and puddle have been completed up to the ground level. an effort will be made to draw the piles, probably using stout three-leg derricks for that purpose, and tapping the adjacent pile with a heavy hammer to loosen the bond between it and the one being drawn and between the latter and the soil.

Later, as the embankment is carried up, the core wall will be carried up with it. The height of the present construction will be made about elevation 225, while the final height of the core wall will be about elevation 285.

Practically all of the material that will be used for concrete and embankment will be brought from north of the core wall. Along the north edge of the sloping banks of the core wall trench will be located four stiff-leg derricks mounted on large platforms of 12x12 timbers, which will travel on a track of about 25 feet gauge paralelling the entire length of the core wall. These four stiff-leg derricks will be used for clam-shell excavation, for handling sheet piling and other materials used in the core wall trench, and finally for handling the concrete for the core wall. At present two are in operation, and two are under construction.



PILE DRIVERS DRIVING 80-FOOT STEEL SHEET PILES WITH STEAM HAMMER

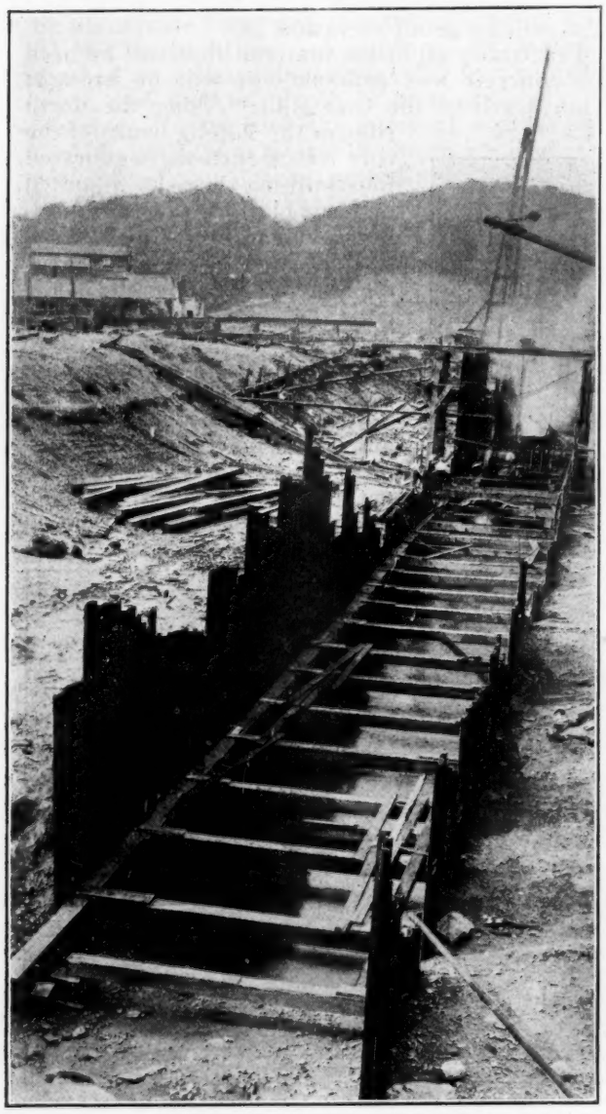
Timber frame is seen in foreground, with a few piles partly driven on each side of the trench at the farther end. At the left are seen the stiff-leg derrick and clam-shell bucket excavating the trench.

The sheet piling work is in charge of J. R. Horton, of Buffalo; a specialist in this class of work, who has been employed by the contractor for taking charge of this part of the contract.

GENERAL LAYOUT OF WORK

Near the south end of the line of the core wall was located part of a large paper mill. This has been destroyed down to the ground surface and the cellars and basement will be filled in with the hydraulicked or other material. Along the bank of the river, the low land had been filled in with paper sludge, which is considered as undesirable material to have in the embankment and this is being removed by steam shovel and side-dump railroad cars and deposited below the lower toe of the embankment.

About 200 feet north of the core wall trench is located the concrete mixer. The concrete will be brought in railroad cars from the mixer to the trench, being carried in one-yard buckets, two buckets to a car. These buckets will be picked up from the car by one of the stiff-leg derricks and their contents deposited in the core wall forms.



TRENCH FOR CORE WALL, TAKEN FROM HILL AT NORTH END
Power plant shown at left background.

The gravel and sand for the concrete will be brought from a bank about 1,000 feet farther north, where an excellent grade of material was found under about an 18-inch cover of top soil. This gravel will be screened, the larger pieces broken by a rotary crusher and the coarse and fine aggregate brought to the mixer by railroad cars. The cement is stored in a shed close to the mixer.

The aggregate brought to the mixer will be dumped into a pit from which it will be removed by a derrick and deposited in the elevated hoppers, from which it will be drawn directly into the mixer. From the mixer it will be discharged into the bottom-dump buckets referred to, which buckets, when filled, will be loaded by derrick on to the cars.

A large part of the work so far has been preparatory; clearing off the land, removing a considerable number of buildings found on the site, including the masonry buildings of the paper mill; laying lines of track for temporary wasting of top soil, material excavated from core wall trench, paper sludge and other excavated material; erecting cement storehouse, concrete mixer and its hoppers and the derrick; and erecting the screen and bins at the gravel pit, laying the track from this pit to the mixer, etc.

All of the plant will be operated by steam unless possibly some pumping may be done by electricity. A central steam plant just south of the dam site furnishes steam for all of the machinery except that at the gravel pit, for which a separate steam plant is provided. The same steam plant will also furnish steam for heating the houses occupied by the superintendents, engineers, etc., of the contractor and of the commission, and also those occupied by the laborers. At present about 250 laborers are employed on the work.

The contractor has already assembled on the ground practically all of the equipment that will be needed for the carrying on of this contract. This includes four Baldwin locomotives and two dinkies, with about 50 Western dump cars and approximately a mile of track. At the gravel pit is a centrifugal crusher manufactured by the Power & Mining Machinery Co. and operated by a Chandler & Taylor Co. engine.

There are two Ransome concrete mixers, one being kept in reserve. One mixer is set on the ground level below the hopper and the reserve mixer is kept directly behind it so that in case of a breakdown in one the other can be substituted for it in not more than thirty minutes. Stuebner bottom-dump buckets are provided for handling the concrete. The excavating at the gravel pit and also the removing of the paper mill sludge is being performed by two Marion steam shovels. The clam-shell bucket used for excavating in the trench is manufactured by the G. H. Williams Co. The dredge pump recently installed is a Morris Machine Co. 8-inch pump, 335 r. p. m., 180 h. p., and will operate against a 145-foot head. There are also pulsometer and electric pumps to be used where needed.

In wrecking the buildings on the site, a considerable amount of lumber was accumulated, most

of it in fairly good condition. Advantage has been taken of this to use it in various ways. For instance, the sides of the gravel and sand bins are constructed of 2 x 4 plank laid up crib-wise with the wide side horizontal and spiked together. These are then lined with one-inch floor boards. Several of the buildings on the site are used for offices, quarters for the laborers, storehouses, etc. All of those above the dam will, of course, be removed ultimately.

The North Jersey District Water Supply Commission consists of Lawrent J. Tonnele, Ernest C. Hinck, Wood McKee and Obadiah C. Bogardus. A. H. Pratt is chief engineer of the commission, M. R. Sherrerd is consulting engineer, and N. C. Holdredge is assistant chief engineer in direct charge of the construction. R. C. Young is the superintendent for W. H. Gahagan, Inc., the contractor.

Garbage Disposal in Philadelphia, Detroit and New Orleans

In Philadelphia the garbage disposal and street cleaning, which has formerly been done by contract is now done by municipal plants and forces in the business section of the city which occupies about one-fourth of the area within the city limits, and it is estimated will be done for the year 1921 with a saving of about one quarter million dollars over the contract system, which at the end of this year will be replaced throughout the entire city by municipal operation.

The work has been organized under the direction of men previously experienced in it, is practically independent of politics, and has been very efficiently carried on. It is combined with the street cleaning and removal of ashes and is largely effected with horse-drawn wagons and sweepers, supplemented by motor trucks, in large groups in plants maintained at different stations, one of which is fitted for the transfer of refuse from horse-drawn to motor vehicles for long hauls. Pains have been taken to select simple, durable plant and standardize it as much as possible in order to promote its maintenance and reduce the number of spare parts kept in stock.

Within the next five years the city of New Orleans plans to perfect a garbage collection and disposal system and plant that will represent the last word in economy and efficiency. Within the next two years the city will spend about $800,000 derived without extra taxation from the regular 1921 budget, for garbage disposal and by the fall of the present year there will have been installed a system of garbage collection costing about $150,000.

Commissioner Black recommends that the city be divided into eight units, each of which will be provided with one motor truck and six mule-drawn trailers, each of the latter being operated by two men, will carry two containers of 2-yard capacity, which will be hauled to a central station whence trains of four to six wagons will be drawn to the dump by motor trucks The cost of this equipment is estimated at $16,000 for each unit, and will replace about 130 carts now used for the same purpose, insuring an estimated saving of one-half the money now being spent and three-quarters of the time now necessary for this work.

The city of Detroit has under consideration an offer made by a German firm which offers to construct a $1,500,000 plant at its own expense capable of disposing of the city's garbage, ashes and rubbish, and to develop sufficient steam as a by-product to furnish power for all municipal purposes. If the plant proves a success the city is asked to obligate itself to take it over.

Under the terms of the offer, the city would turn over all its garbage, rubbish and ashes to the plant which the firm is willing to build. The ashes and rubbish would be used by the plant to dry out and burn the wet garbage. Steam developed in the process would be available to the city for the generation of electric power or for heating purposes. The electrical equipment would have to be furnished by the city.

The offer was referred by the council to City Research Engineer McCabe for investigation.

Road Work in Venezuela

According to consular report the federal government in Venezuela has constructed, reconstructed or repaired since 1908 about 1,863 miles of roads and has now about 1,242 miles under construction or repair.

In the rocky, mountainous country the construction cost has amounted to a maximum of $31,000 per mile, equivalent to about $2.60 per square yard of roadbed. Telford macadam roads cost from about $.65 to $1.10 per square yard.

The road maintenance is performed by overseers who also police the traffic and can attend to from 1¼ to 2 miles of road. The work is financed by an allotment of 50 per cent of the public works revenue, which for the current year amounts to about $738,350. At present the principal operations are in the construction of the great Occidental and Oriental roads which will have lengths of about 542 and 628 miles, respectively. These roads traverse the whole republic from east to west, connecting the main productive parts of the country, and are supplemented by a number of roads to the seaboard.

Coosa River 120,000 H. P. Hydraulic Power Development

The Alabama Power Company has been licensed by the Federal Power Commission to construct at Duncans Riffle on the Coosa river, Ala., a concrete dam 1,200 feet long, to develop a head of 68 feet and retain water in a 6,000-acre reservoir. Only a portion of the potential energy will be at first developed by an installation of two 24,000-h. p, vertical units with single runner turbines and a transmission line 12 miles long to connect with the existing line of the company. Units will be located in separate enclosures on the upstream side of the dam and the draft tubes will discharge upward at the toe of the dam in order to reduce the loss of head in high water. Provision will be made for the future installation of three more units when required.

Naugatuck Valley Road

Signal and telephone service installed to control one-way traffic on portions of a very crooked concrete road built in longitudinal halves. The materials handled by industrial railway.

The state highway in the Naugatuck valley, Connecticut, runs south from Waterbury towards Bridgeport, through a very narrow valley and makes many sharp turns where it follows the contours in the bases of the hills. The new road substantially keeps to the location of the old macadam road, of which it is practically a reconstruction, but in several places the alignment is changed somewhat to eliminate bad curves or secure other advantages. There was, therefore, comparatively little grading to be done and the work consisted chiefly of removing the old macadam and building a new foundation with it and with additional materials, provided wherever necessary. Most of the foundation work was done with scrapers and steam rollers, and as there was no opportunity to detour the traffic, the new concrete surface, 20 feet wide, was built in two successive longitudinal halves, permitting traffic to be maintained without interruption, at first on the old road while the first half of the new road was being constructed, after which the traffic was transferred to the latter and the remainder of the old road was replaced by the new.

ALTERNATING ONE-WAY TRAFFIC

The number of curves and their short radius, together with the necessity of occupying part of the roadway by construction operations, limited the traffic at some points to an alternating one-way system, by which a number of vehicles from the north were allowed to pass, while the southbound traffic was held up and then the accumulated traffic for the north was permitted while the southbound vehicles were stopped, thus operating in five or ten-minute periods all day long. To regulate this traffic it was necessary to provide a large number of flagmen, especially where the curves were sharp and close together, so that at one time the cost of the flagmen was about $2,500 to $3,000 per month.

Eventually a field outfit was secured from the telephone company and a telephone was installed at each end of every section of one-way traffic. On the receipt of a telephone message at the south end of the section that ten cars were coming through, the last one No. ——, the operator at the south end would halt all northbound traffic until the last of the ten cars passed, when he in turn would telephone to the north end that ten cars were coming through, the last one No. ——, and southbound traffic would be held for them, and so on all day long, thus enabling all the intermediate flagmen on the section to be cut out, and effecting a saving of about 80 per cent in the cost of handling the traffic on the job.

The method really approximated that of railroad train dispatching and the only trouble was when a wagon would occasionally get in the way of automobile traffic and delay everything behind it until it passed off from the section. This did not, however, occur very often as few teams used the road and there was no complaint from drivers during the construction.

COST AND QUANTITIES

Broken stone was delivered by the trolley cars over an adjacent parallel track and was thus easily distributed along the line in advance of the mixer. Sand and cement were delivered by automobile trucks.

HANDLING SPOIL WITH AUTOMOBILE TRUCKS IN ROCK CUT

WIDENING ROAD BED AT CURVE

The work was done by Messetti & Holly, of Torrington, on the cost plus basis. The state paid all bills for labor and material as fast as they became due and the contractor furnished all machinery, plant, equipment and supervision, and for it received a fee amounting to 10 per cent of the engineer's preliminary estimate of the total cost of the work. The actual cost of the work, including the contractors' fee, was $405,000, and the original estimate was $400,000. Owing to the necessity of maintaining traffic, the rapidity of construction was not as great as might otherwise have been attained and the best record was for the completion of 600 linear feet of the half-width concrete in one day. The work was commenced about January 1, 1920, and completed December 1, 1920, with an average force of 75 men. The principal quantities involved included 15,000 yards of concrete, 2,500 yards of rock excavation and 32,000 yards of earth excavation.

Ideal Highway Construction

General conditions, requirements, specifications, cost and equipment for concrete paving in Minnesota and vicinity.

In making a thorough study of the construction of a one-course concrete pavement of the Minnesota specifications for 1921, various ideas and conditions were assumed that are enumerated in the general specifications that provide substantially as follows:

GENERAL SPECIFICATIONS

Subgrade. The subgrades shall consist of a graded roadway at least 30 feet on the crown in such condition that no part of it is more than one-tenth of a foot from the true grade. It shall be in such condition that no material shall be handled more than 10 feet to prepare it for concreting. The material in the roadway shall be sandy loam.

Line and Grade. The road shall be straight, except for curves that do not require widening or superelevation and shall have grades of not over 1½ per cent. No bridges, crossings or other structures shall interfere with construction operations.

The contract shall be awarded prior to January 1 in the year in which the work is to be done.

The work shall include 21 miles of paving, no part of which shall be 3½ miles from the railway siding.

Railway Facilities. Within one half mile of each 7-mile section there shall be railway facilities and within 500 feet of the highway there shall be a suitable location for its 1,000 feet of railway trackage open at both ends, and suitable storage space for aggregate and other material. There shall be train service for handling materials promptly, providing at least two switches daily.

Sources of Supply of Material. Sources of supply of material, except steel, shall be at such a distance from the unloading plant that a freight rate of $.05 per hundred pounds will apply on sand and rock. They shall be of abundant capacity and cement shall be delivered in such a way that a storage of 3,000 barrels will be adequate.

Water Supply. The water supply adjacent to the roadway shall be sufficient for at least 40 gallons per minute, and must be located so that a maximum of not more than 3 miles of 2-inch pipe will be required.

Detours. Detours will be provided and maintained by the owners so that traffic over them shall be preferred by the traveling public to traffic over the open section.

Detailed Specifications. Detailed specifications shall be the same as for the Minnesota State Highways for the year 1921: The committee does not believe that the most efficient method of laying concrete pavement has yet been definitely established and does not recommend any particular method of laying concrete pavement, the decision of which should be the result of a careful study of the geographical and financial limits of the job.

In Michigan, Illinois, Iowa, Minnesota, Oregon and Washington, the two methods in general present use for laying concrete pavement on highways are by hauling dry aggregate in trucks to the mixer and by hauling dry aggregate on railway track with locomotives to the mixer.

It is assumed that the working period of each year averages 100 working days. Capacity of the paving mixer and of necessary hauling equipment, is 400 linear feet of pavement per day per unit. The ideal job is carried out in three paving units, in one operating season. The prices of rock and sand delivered on the job are, respectively, $2.75 and $1.50 per ton, cement $2.50 per barrel and steel $.035 per pound. The wages per hour are: labor $.50, cement handlers $.65, machine operators $.75, teams $.90.

The trucks used are of 2½ tons capacity, equipped with pneumatic tires and carrying two 4-bag dry batches. For hauling by railway track, flat cars are used carrying two steel batch boxes of 4-bag capacity and hauled by 6-ton gasoline locomotives. Rock and sand are unloaded from railroad cars and stored in old charging bins by means of a 20-ton locomotive crane with 60-foot boom and a 1-yard clamshell bucket.

ESTIMATE OF COST

The principal items in the estimates are depreciation; interest at 6½ per cent on an assumed capital of $75,000 for each paving unit; supervision, including general overhead of 2 per cent, plus $5,000 salary of contractor himself in charge of three units and a foreman for each unit; taxes and licenses on automobiles; storage at 3½ per cent per annum on the plant installed; bonds at 1½ per cent on $300,000, or $4,500 for each paving unit; workmen's compensation and public liability insurance at 3 per cent of total payroll, plus fire insurance; $500 for railway fares for each

*Abstract of Report of Committee of Education as to Costs, Northwestern Association of General Contractors, published in July Bulletin of Associated General Contractors of America.

unit; ground rent of $250 for camps, storage space, and tracks; $1,500 for 1,000 feet of track and switches; repairs according to the official rental schedule of the Associated General Contractors; contingencies 5 per cent; labor, fuel and oil and aggregate according to schedules presented in detail.

Losses from Watersheds

These, the principal factor in determining run-off, are of three kinds—interception by leaves, evaporation from soil and transpiration through leaves. The value of reforestation of watersheds is considered doubtful.

The New England Water Works Association appointed in 1918 a "Committee on Rainfall and Run-off Measurements," the purpose of which was "to consider the collection and standardization of rainfall and run-off measurements." A progress report was submitted by this committee in 1919. This year the committee made a report giving data collected at Hartford, Conn.; Fiskeville Dam, and Pawtucket, R. I.; Cambridge, Westfield, Southampton, and Fall River, Mass. The committee did not undertake an analysis of the records or deductions therefrom, but merely presented the measurements furnished to them, tabulated according to a standard form.

Following the reading of the report before the society, however, the chairman, Robert E. Horton, gave his personal views on certain points in reply to questions by members. There we have condensed and assembled in the following paragraphs.

Apparent water losses are the principal factors, aside from rainfall, which determine the amount of run-off, being the difference between measured precipitation and run-off. Such difference is not necessarily the true or actual water loss for any short period of time, since it includes the effect of gain or loss of storage from ground water, soil, lakes, swamps, marshes, stream channels, and reservoirs.

Water losses are generally found to be more nearly constant over large areas than either precipitation or run-off, and the use of water losses as a factor in estimating or extending stream flow records is apparently increasing.

Water losses are classified by Mr. Horton as of three kinds: Precipitation that never reaches the ground; evaporation from the soil, and transpiration through leaves.

On a forested area, an average of probably 20 per cent of the rainfall is intercepted by the leaves, and may reach 25 per cent. The kind of tree affects this percentage very little. However, in case of a heavy storm the percentage that does not reach the ground may be very much smaller, while on the other hand it may be greater in case of a drizzle. In the eastern states the rate of rainfall averages a third of an inch per rain-day.

Where the land is cleared and under cultivation to clover, corn, potatoes, etc., the interception may be only 10 or 12 per cent. If farm land is allowed to run wild and grows up to wild grass, the interception might not be more than 5 or 6 per cent.

Evaporation is more in a cropped field than in a forest, and more in a bare field than in a cropped one. It may be about 10 per cent in a forest, 25 per cent in a cultivated field, and 33 per cent in uncropped land.

The percentage of rainfall that percolates through the soil and is drawn up in the roots of the plants and passes out by transpiration through the leaves is relatively large. It may be 10 to 14 inches a year for a growing crop. It may be 25 per cent in a forest, 30 per cent in a cultivated field, and only 5 or 6 per cent in uncropped open land.

From these figures it appears that the total loss might be 55 per cent in a forested area, 65 per cent on a cropped area, and 50 to 55 per cent if the area be allowed to grow wild.

This appears to indicate that forestation of watersheds is not effective as a means of increasing run-off, in fact, may decrease it; and such is Mr. Horton's tentative opinion, although he stated that he may change it when more data are available.

Whether the loss was greater or less in the case of a heavy, dense forest than in a scrub second-growth on a burned-over area he could not say. Young plants generally transpire water more readily and rapidly than do old ones in proportion to the weight of dry matter produced in the plant; but on the other hand the transpiring surface is much smaller. On which side the balance of these two counteracting effects would fall he could not say.

Asphalt-Dirt Mixed Road in Texas

A new type of road constructed by mixing dirt and asphalt is one using what is known as the Hunt Process, such a road having been built in Dallas county by L. S. Franklin and J. A. Falconer, of Dallas. The earth there is what is known as "black land."

First a trench was plowed about five inches deep as for making a gravel road, the dirt was thrown out on the shoulders and the subgrade rolled with a tamping roller. It was then given a seal coat of 2½ gallons per square yard of "Texaco" Macadam Binder. The dirt previously cast out was then thrown back to the center of the road and pulverized with harrows, tractors and rollers. Then binder was applied at the rate of one-quarter gallon per square yard for each of three applications, the earth and asphalt being mixed with spring-tooth harrows, disc harrows and mixing tampers after each application. After the final mixing, the surface was rolled with tamping rollers and finally with a regular road roller. A final seal coat was then applied to the surface of the road and lightly covered with pulverized earth. The entire mixture is about 5 inches thick and contains, including the subgrade seal and the surface seal, about four gallons of macadam binder per square yard. The tamping roller used contains tamps, each about 4 x 6 inches and the weight is about 450 pounds to the square inch of bearing surface.

Snow Surveys in California

State Department of Engineering has employed Prof. J. E. Church for making such surveys on the watersheds of that state, using special appliances. To be used for forecasting summer stream flow.

In his report recently published, describing the operations of the Department of Engineering of the State of California, W. F. McClure, State Engineer, describes, among a great number of other matters, the steps taken for securing snow surveys on the water sheds of the state, chiefly with a view to securing the data necessary for predicting the volume of spring floods and of water which will probably be available for irrigation. As he states, at most artificial reservoirs accurate records are kept so that it is known at any time how much water is available for future use, but no knowledge whatever is possessed at any time of the quantity of water stored in the vast snow fields at the heads of the streams which must come down when warm weather melts the snow.

Professor J. E. Church, Jr., of the University of Nevada, has for years been conducting studies of the phenomena connected with precipitation in the form of snow. In co-operation with the university, the local representative of the United States Weather Bureau and sympathetic friends, Professor Church had accumulated some valuable meteorological apparatus and established an observatory on the summit of Mount Rose at an altitude of 10,800 feet, overlooking Lake Tahoe. This observatory was equipped with self-recording instruments which run continuously and make written records on graphs showing the meteorological conditions for every minute of the day. These instruments accurately record the temperature, barometric pressure, atmospheric humidity, rain fall, and direction and velocity of wind. Precipitation other than in the form of rain cannot be correctly recorded and must be determined manually.

These instruments will run and make their written record without attention for six weeks, when they must be readjusted and the record sheets changed. It requires two days to make a trip to the mountain observatory by men expert in the use of snow shoes and inured to hardships. While at the summit, an observer makes determinations of the water content of the snow which has fallen, which gives a true measurement of the precipitation not measured in the rain gauges. The apparatus for measuring the water in the snow was developed by Professor Church, and two or three years ago when the California Department of Engineering took up the study of snowfall, it found that no instruments of this kind could be obtained, none being in existence except those manufactured by Professor Church. The state accordingly purchased all the equipment used by him and also engaged his services, thus insuring that the observations would be continued without a break and also arranging for training members of the department's staff in the technique of making observations. The equipment so purchased was first used for making observations in a few snow basins in the winter of 1918-19, but it was extremely difficult to obtain additional apparatus. Only recently, after nearly two years of effort and through the assistance of Professor Church, the department has accumulated sufficient apparatus to enable the investigations to be extended to several of the most important stream basins.

The department believes that after a few years' operation in a given water shed it will be able to forecast early in the season with a reasonable degree of accuracy the quantity of water that will flow in the stream later in the season. Probably reservoirs will eventually be built wherever available sites are found, to be used for both flood control and irrigation, when information shall be available as to the quantity of water held in the basins in the form of snow. In the absence of that information, the irrigator will demand that the reservoirs be filled with the first water that comes, for if held empty on the chance of high water later, there may not be enough to fill the reservoirs for his use. On the other hand, those whose lands are subject to injury from floods will contend that the reservoirs must not be filled until the danger of floods is passed, else when the flood does arrive there will be no storage space for it. If definite information is had as to the quantity of water being held in reserve by the small fields, however, it will be known in advance when it will be safe to fill the reservoirs. Moreover, if an irrigator should know in the spring that the snow will furnish insufficient summer water, he will not plant crops requiring late irrigation.

The studies so far conducted have enabled a start to be made in forecasting, and though the data have not been as complete as they will be when the system becomes fully developed, the close agreement of the prognostication with the measured run-off in the instances attempted has been very gratifying.

The data obtained from the recording instruments at the observatories give information as to meteorological conditions preceding and during the accumulation of snow. From these records it is known whether the ground was primed with water before the snow fell or whether it was dry and absorbent; whether it was frozen so as to resist the penetration of the water from melting snow.

To obtain a sample of snow, a straight steel tube armed with a serrated annular cutting bit of a peculiar pattern is used. The bit is brazed or sweated into the hollow shaft (not screwed on) so that there is no joint to catch the snow. The tube is made up in sections for convenient transportation and handling and is screwed together to make lengths up to about 16 feet. The couplings are so made that the sections butt together in a smooth joint. The tube has narrow slots cut in the walls on opposite sides so as to break joints and not weaken the shaft. These slots serve

as windows through which to observe the column of snow within and through which to insert a tool for cleaning out the snow. On the outside of the tube is a gauge etched in the metal graduated in inches, measured from the edge of the cutter. The inside surface of the tubes is machined and polished to a high degree and the interior is varnished after being used in order to eliminate friction of the snow to the greatest degree. The couplings are made as thin as consistent with the requisite strength and turned down to a feather edge at the ends so as to offer least resistance to penetrating the snow.

The sample of snow is obtained by forcing the tube to the bottom, to do which a heavy wrench is applied, by which to turn the tube and upon which weight is applied to force it down. The rotary motion is necessary to cut through layers of frozen snow. As the tube descends, it cuts out a column of snow which rises inside. When the bottom has been reached, the tube is taken up and weighed. The weight of the empty tube is known and the scale calibrated so as to express the net weight of snow in inches of water.

The scale is of the spring balance type but is more carefully constructed and calibrated than are any of the stock scales found in the market.

A "snow survey" consists of selecting courses which seem to the operator typical of average conditions in the snow field and taking many, sometimes hundreds of samples of snow, each of which is weighed for its water content. In a small field or one with uniform topography and exposure, one or a few courses will be sufficient; but in a broken and rugged country covered with timber, a great many courses may be required to obtain a good average. The work is done in high mountains, remote from habitations, and is strenuous to an extreme degree. It requires men of good health, inured to hardships, endowed with sound judgment, unyielding determination, possessing good knowledge of woodcraft and acquainted with the geography of the country. The operator must carry, in addition to his instruments, food and bedding for camping overnight. The department has made a rigid rule that no trip into dangerous territory shall be made by one man alone but always with a companion, since an accident which might be trivial elsewhere becomes a momentous matter in these remote regions, and serious injury or storm means almost certain death.

$6,000,000 California State Highway Contracts

Thirty-five new contracts for approximately six million dollars' worth of work have been let by the California Highway Commission during the first six months of 1921.

This work was distributed all over California and bids on other sections are being asked and a large highway program is well under way.

The 1921 contracts that have thus far been let are for work in the following counties: Fresno, Tehama, Shasta, Santa Barbara, Kern, Humboldt, Butte, San Luis Obispo, Mendocino, Placer, Nevada, Sacramento, Amador, Solano, San Mateo, Tulare, Los Angeles, San Diego, Mono, Mariposa and Glenn.

Labor for Unemployed on California Highways

The state highway engineer of California, A. B. Fletcher, estimated that at the end of July there were 2,500 men employed on highway contract and maintenance work in that state, 1,500 of these being on contract work. The recent sale of $4,780,000 worth of highway bonds will enable the highway commission to let more highway contracts, providing work for hundreds of more men.

Since January 1, 1921, sixty-three contracts have been let, totaling $7,916,875.

Sewerage Conditions in Indianapolis

It is estimated that only 65 per cent of the houses of Indianapolis are connected with sewers where sewers and water are available, while, in addition, there are many parts of the city where they are not available. Open vaults consequently exist by the thousand in the city, and the city health department, which has recently completed a sanitary survey of the city, asks the city council to pass an ordinance prohibiting the maintenance of open vaults within the city after October 25; and requiring that all houses be connected with the sewers and water where these are available, and where they are not that septic tanks be installed. One of the objectionable features of the vaults is that "there are being hauled through the streets daily from 75 to 100 loads of night soil, which is dumped on the ground less than two miles from the heart of the city. . . . The night soil wagons and cleaning outfits are an offense against common decency and an insult to public health," according to Dr. Herman G. Morgan, secretary to the health department.

Another cause of insanitary conditions is that "many sanitary sewers in nearly every part of the city are not operating properly. The trouble often is caused by stopping up the interceptor. The overflow then dumps raw sewage into streams that pass through the residence districts. In some of the best residence sections it is almost constantly possible to detect the odor of sewer gas. Complaints have been received by us repeatedly, and found to be well-founded." This condition is partly due to the fact that sewer-cleaning gangs are not properly supervised and that much of their work is not done properly.

Philadelphia-Camden Bridge

The board of engineers in charge of the construction of the Philadelphia-Camden bridge across the Delaware river consists of Ralph Modjeski, chairman and chief engineer, George S. Webster and Lawrence A. Ball, who will have complete charge of the design and construction of the bridge and will advise the bridge commission on all matters pertaining to the project, will employ experts when necessary, and maintain an inspection department, an assistant to the chief engineer and chairman, an engineer for the design of the approaches, an engineer of the design of the main bridge and three engineers of construction.

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S. W. HUME, President J. T. MORRIS, Treasurer
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FRANK W. SKINNER, Associate Editor

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Reforestation of Watersheds

Is the yield of a watershed diminished by cutting off the trees or increased by reforesting? This question stands without a generally accepted answer after many decades of discussion and investigation. Forestry enthusiasts claim it is. Others dispute it or at least insist that it has not been proved. In this issue a water works engineer who has studied the problem gives it as his tentative opinion that the yield is greater when trees have been cut off and the ground allowed to grow up to wild grass, and questions the advisibility of reforesting a water works watershed.

It seems to us, however, that decision as to reforestation should not rest solely upon the results obtainable in increasing total yield. Total yield is important, but is less so in most cases than uniformity of yield, decreasing erosion of soil, reducing evaporation from reservoir surface by diminishing wind velocities across it; all of which result, we believe, from the presence of trees on a hilly or mountainous watersheds, and most watersheds (or catchment areas, as they are more appropriately called by some) in the eastern states are hilly or mountainous.

There would seem to be no question that the roots of trees and the forest mat of dead leaves and wood prevent erosion on slopes, and greatly increase the percolation of water into the soil and and the resulting ground storage. This means less immediate run-off from rains and therefore less loss over the spillway. It also means less sediment carried into the reservoir to diminish its capacity, and less turbidity to be removed from the water.

Another argument in favor of reforestation is the profit of it considered as an investment. By scientific cutting of the trees and yearly replanting, a wooded watershed may be made a source of continual revenue, most of the labor on it being done at times when the regular force of the department or water company have no other outside work on hand. Several instances of this have been described by us during the past few years.

Fixed Fee Road Contracts

The use of a special cost-plus basis of contract for construction of concrete highways under difficult and uncertain conditions is found satisfactory by the State Highway Department of Connecticut as illustrated by the description in this issue of a half million dollar job that was somewhat hampered by maintaining traffic on a crooked line under construction.

All of the Connecticut state road maintenance is done on force account and most of the new construction, including bridges of the longest spans, by competitive contract, either lump sum or unit price.

On special occasions where conditions preclude exact estimates, and lump sum or equivalent contracts are likely to involve uncertainty and high prices, a special contract providing for the payment of all labor, material and equipment costs, plus a predetermined fee for supervision and contractor's profit, has been found practical and satisfactory. The fixed fee has been approximately proportioned to the total reasonable cost of the work by making it an agreed percentage of the engineer's preliminary estimate.

So far this form of contract has been adopted in cases where particular difficulties and uncertainties were anticipated, making it impractiable to provide satisfactorily for them in the specifications; as when unforeseen difficulties impede the handling of the traffic or may delay the work and cause additional expense. This burden, and that due to arbitrary charges, should properly fall on the owner where it is placed by this arrangement that also settles on him the entire cost and all risks and on the other hand frees him from paying undue profits.

Properly administered, accounted, and executed, such a contract as this is not far from ideal under certain conditions, although it has the possible

objections of eliminating general competition and removing the incentive for extraordinary efforts to reduce cost. It is, of course, possible to reduce these disadvantages by permitting the contractor to bid a minimum amount of percentage he would accept, and by offering a bonus of a certain percentage of any saving effected over the engineer's preliminary estimate. The latter may, however, be held to imply a corresponding over-payment when extra cost is developed. The desirability of such a step must necessarily depend to a large degree on the character of the work and on the wording and proper enforcement of the contract and specifications.

Under favorable and well-defined conditions where there are many or large standard items that afford special opportunity for excellent management and commercial and financial manipulations, the award to the lowest bidder for a fixed price or unit price stimulates competition and the effort to introduce advantageous management and operation.

Where there are great uncertainties, delays or the probability of important changes, the cost-plus system is attractive, provided exceptional ability and integrity of the contractor and his familiarity with the same kind of work, and the provision of abundant equipment of all necessary plant, machinery, and complete executive organization without extra charge, is assured.

The specifications should leave no possibility of disagreement as to the furnishing by the contractor of all equipment of every sort that is used and the inclusion of all kinds of supervision and direction so that no extras of any sort will be charged and that there will be no incentive to hold plant idle on the job in order to rent it at large prices, to supply unnecessary equipment, or to provide occupation for supervision not necessary on the work. It is well demonstrated that no possible type of contract is best adapted for all conditions, but this form seems to have positive advantages for the conditions under which it has been successfully used.

Shelburne Mountain Road

Heavy construction on a $300,000 contract for 5 miles of concrete highway in Massachusetts in the Mohawk Trail region. Heavy grades eliminated by location requiring many preliminary surveys. Cost increased by one-way delivery of materials. Abundance of power equipment installed. Average progress nearly 300 linear feet of 18-foot pavement daily. Sand and concrete tests notably above specification requirements.

The Shelburne Mountain road, now under construction through the beautiful scenic regions in District No. 2 of the Massachusetts Division of Highways, involves a large amount of heavy construction. The route was designed and construction begun under the control of the State Department of Highways, A. W. Dean, chief engineer, F. C. Pillsbury, construction engineer, and H. D. Phillips, district engineer. The contract, amounting to about $300,000, was awarded to Coleman Brothers & Co., Inc., of Boston, P. J. Burns, superintendent. The work was commenced September 1919, is now more than 75 per cent finished, and it is expected will be completed this season.

The alignment, about 5 miles long, consists of tangents connected by long radius banked curves with maximum grades of 6 per cent, one of them having a length of nearly 9,000 feet. The road winds through a very beautiful and picturesque region, forming an approach to the historic Mohawk trail used by the war parties when attacking the Pocumtuck tribe in Deerfield.

The location was very difficult and required a great deal of reconnaissance and surveys extending over several years. Half a dozen or more preliminary locations were made by the State Highway Department and trial lines estimated from the stadia and vertical arc measurements eventually culminating in the selection of a route that eliminates the last steep grade (12 per cent) remaining in the route from Boston to Williamstown and Albany.

About two-thirds of the location is an entirely new line, most of it terraced out of rocky hillsides, involving about 40,000 yards of earth and 16,000 of rock excavation, just about balancing the required fills and embankments with moderate-length hauls averaging about 1,000 feet. The width of the hardened roadway is 18 feet, increased to 21 feet on curves, which are well banked.

In the final location the center line stakes are driven 50 feet apart and one on each side and on each of them is inscribed the elevation marked with Dixon's lumberman's blue crayon that will be legible for years. Slope stakes are set at the tops of deep cuts and at the bottoms of high fills. At all points the line and elevation are given by the resident engineer to the contractor's superintendent and are transferred to subgrade and the finished work by chalk line, level and straightedge. The different stages of the work are checked up by instruments as soon as completed and any material deviations are immediately corrected. Generally the state has secured a right of way 100 feet wide, nowhere less than 70 feet wide, allowing ample room for slopes and protection against falling trees, landslides, rolling boulders and the like.

In some places where the road winds along high on the hillside it commands beautiful prospects and distant views of New Hampshire and Vermont mountains and it is proposed to secure the funds and authority necessary for building occasional lookouts carried beyond the roadway

and protected, if necessary, by high retaining walls and massive parapets, which will greatly enhance the road for touring.

Great pains are taken to secure a substantial foundation and to drain it thoroughly, thus providing for durable, strong bearing surfaces. Ditches, tile drains, blind drains and the like are abundant and the drainage from them flows away rapidly to the brooks or streams in the vicinity. In wet hillside cuts, ditches are excavated 10 feet clear of and parallel to the edge of concrete surface, and are carried down about 2½ feet below grade, and drained through pipes or culverts.

Considerable drilling and blasting were required in the deep cuts to shatter the rock so that it could be handled by the two ¾-yard Erie steam shovels, each of which delivered the spoil to from 10 to 20 teams that hauled it directly to the nearest fill. Ingersoll-Rand tripod and jackhammer drills were always operated in advance of the steam shovels to shatter the earth and rock and also for a considerable amount of block holing. Light holes were charged with 40 per cent, and heavy ones with 60 per cent dynamite, but none of them were sprung. The drills were operated with compressed air that was provided by a 20 h. p. Sullivan compressor and steam for it and other purposes was supplied by four portable vertical boilers. The shovels were always moved before each blast of the working face in rock cuts.

The cuts were made 24 feet wide on the bottom and the embankments were from 24 to 28 feet wide on top and the slopes were rip-rapped when at 45 degree angles. The slopes of rock cuts were ¼:1 and of earth cuts 1½:1. The deepest cuts were 20 feet and the highest embankments were also 20 feet. In all cases where embankments were built on side hills the latter were plowed before the fill was placed. The embankments were finished with a natural slope, no retaining walls being built. Earth embankments were made with 12-inch layers, that were so well compacted by horse-drawn rollers that no settlement occurred in them after the road was built on them.

All foundations were made with 12 to 18-inch layers of rock from 8 inches in diameter down to fine pieces and were underlaid in wet places with 6 inches of sandy gravel to afford additional drainage. The stone foundations were carefully hand packed and the voids filled with sand, thoroughly rolled with a 12-ton Buffalo-Pitts machine. The stone foundations are built accurately to subgrade, and are tested with a template riding on the side forms just ahead of the construction of the concrete pavement.

The cement, sand and stone conform to the requirements of the Federal Aid Road specifications, the sand being of a remarkably fine quality that is more than 100 per cent of the test requirements.

The cost of the work was materially increased by the necessity of hauling all road materials from one end only of the line. Cement was hauled daily, distances ranging from ½ mile to 6 miles and was delivered only as required, only a dozen or so bags being left over night on the job. The stone and sand were hauled from 2½ to 7½ miles in 3-ton and 4½-ton Mack trucks.

Aggregate was hauled over the completed roadway and delivered in piles on the subgrade adjacent to the 2-bag Koehring mixer, that early in the season had run at an average rate of about 275 linear feet daily, equivalent to 290 cubic feet of concrete, a progress which has since been increased to about 300 linear feet per day. The 1:2:4 concrete contains 8 per cent of the cement bulk of hydrated lime and is required to be mixed for one minute.

The concrete, dumped from the bucket of the mixing machine, is approximately spread by hand, shoveled and raked, and on tangents is finished by a Lakewood tamping and finishing machine. The machine cannot be operated on curves and therefore the banked surfaces are finished by hand, being screeded with a 48-pound rail, dragged by four men, after which the surface is floated by men working on bridges. The surface is later roughened with stable brooms.

The concrete is placed between Blaw-Knox forms, of which 1,200 linear feet are provided. Water, at 100 pounds pressure, for concrete mixing, curing and other purposes, is delivered through a 1½-inch pipe laid by the contractor and connected to a Dean steam pump at the section, which is shifted every mile or so to draw from the more convenient supplies which are found in abundance all along the line.

The contractor has about 300 linear feet of 6 x 22-foot light wooden frames 2 feet high that are covered with canvas and protect each day's section of fresh concrete until it has set and after an average time of 16 hours is covered with 2 inches of earth and for 2 weeks is kept saturated with water, two or three men constantly being employed spraying it with hose from the service pipe alongside. The total force averages about 80 men.

Expansion joints are provided at the end of every quarter day's work and great care is taken to make them exactly at right angles to subgrade. They are made with 3-ply asphalted paper.

Daily slump tests are made of concrete, taken fresh from the pavement, and placed in a truncated conical sheet steel form 12 inches high, 8 inches in diameter at the base, 4 inches at the top. The test concrete is thoroughly rodded with a ½-inch diameter pointed pin, the top is carefully leveled, and the form immediately withdrawn, permitting the concrete to slump without restraint. The average amount observed has been ¾ inch for concrete that has been tamped with the Lakewood machine and 1 inch for hand concrete, although the specification allows slumps of 1½ inches and 3 inches, respectively, for these conditions. It is considered that a large factor in obtaining these results is the close adherence to the theoretical water content of the concrete, the water ratio being maintained at one, which makes a dry and uniform, plastic product, which has proven very satisfactory. The numerous slump tests made have been allowed to harden alongside the road and many of the specimens may still be noticed where they have been aban-

doned, that look almost as perfect and symmetrical as though they had hardened in the form without being removed or slumping at all.

The work is being executed by an average force of about 12 two-horse teams, 7 trucks, and 80 men, first class labor being abundant at prices varying from 35 to 50 cents per hour.

Charleston's New Filter

Plant of fourteen million gallons capacity constructed under supervision of department for less than the lowest bid received.

The Water Department of Charleston, S. C., has built by day labor a new filtration plant to take the place of the old "tub" filters, and believes that it has saved money thereby, besides saving itself a lawsuit and much annoyance that would have resulted from the unforeseen conditions that a contractor would have encountered.

The plant contains fourteen one-million-gallon concrete filter units with "Wheeler" bottoms. An old standpipe erected in 1880 was taken down and re-erected for use as a wash-water tank.

The manager and engineer of the department, J. E. Gibson, secured authority to build the plant under his own management rather than by contract, and contracts for materials, including a construction plant, were entered into early in 1920. The construction plant cost $10,150 and $368 additional was paid out for small tools.

The razing of the old standpipe was completed early in January and re-erected on the new foundation completed in April, the standpipe going into service on April 22, when the removal of the old filter plant was begun. One filter unit was poured on May 27, another on June 17 and two filters on July 15. Construction of the Wheeler bottoms was begun the second week in July and the first filter went into service October 5, a second 20 days later and the third, December 15.

Two more filters were poured on November 5, two on November 30 and two on December 21. By January 1 of this year three filters were in service of the eight that had been poured.

The work was greatly delayed by difficulty in having material delivered, little construction being done between the middle of July and October, when the forces were more or less disorganized.

It was estimated that the cost of the plant complete would be $123,213, including the cost of the construction plant which was estimated to have a salvage value of $3,000, leaving the net cost about $120,000, including the standpipe, outside piping, engineering and other expenses. The original estimate was $118,300, but this was made before the increase in cost of materials, freight and labor of 1920. Further, the cost was increased by the delays and by the necessity of maintaining the supply of water to the city meantime. Concerning the cost, Mr. Gibson said:

All of these contingencies were in a measure considered in making our original estimate, but no one other than a pessimist could have foreseen all of the difficulties to be encountered in this operation.

We are satisfied that had we let this work by contract, we would have been subjected to inconveniences, arguments and claims for liquidated damages due to the inevitable delays incident to maintaining the water supply service. These claims would have probably resulted in legal proceedings before they could have been satisfactorily adjusted.

As the work progressed your officers were more than ever convinced of the wisdom of the commission in authorizing the department to carry on this work under their own management, and we believe this view is entertained by the members of the Commission.

The lowest contract bid received, you will recall, amounted to $127,050, and therefore it is seen that we will probably effect an actual saving of $7,000 in cash, plus whatever claims the contractor might have presented and collected, rather than go to law, not considering the arguments and bickerings which would have arisen by lack of co-ordination between the contractor and the department forces.

MUNICIPAL USE OF WATER

The department furnished fire protection through 629 hydrants and the city had the right to use 300,000 gallons per day for flushing sewers and other corporate purposes. For this service the city paid $44,000 a year plus $25 per hydrant for all hydrants in excess of 600.

It was found that the city was using more than 700,000 gallons a day for sewer flushing alone. Meters had been installed upon all municipal services except the sewer flush tanks, and upon discovering the excessive use of water by these, periodic inspection and tests were made to keep the waste of water by them within a reasonable amount. This was doubly important, as all of the sewage had to be pumped. The water used by the flush tanks during 1920 was estimated to have been 14,600,000 cubic feet, valued at $13,900.

The other municipal uses for the year totaled 7,522,380 cubic feet, valued at $10,440. This is 50 per cent more than the amount arranged for and by co-operation with the managers of various city institutions the department hopes to eliminate most of the useless waste by these services.

Of the 9,430 taps on the system, 98.4 per cent were metered at the end of 1920, and it is hoped to meter practically all of the remainder this year.

Of all the water filtered and pumped to the city during the year, 80.4 per cent was recorded by service meters, at times 85 per cent being accounted for. It is believed that an average of 85 per cent of all water pumped will be metered and billed when the services are all metered.

On account of the nature of the soil it is found advisable to lay all services of lead pipe. There are a great many galvanized iron services in the city and many small wrought iron mains laid by property holders, and the latter are being replaced by cast iron and the former by lead, more than $3,000 having been spent in this work last year.

Consulting Engineers J. V. Davies and Ralph Modjeski have reported to the San Francisco Motor Car Dealers' Association recommending the construction of a road from near Mission Rock to the proposed naval base in Alameda which would include about 3,000 linear feet of tunnel, consisting of three parallel tubes providing altogether for one 20-foot roadway and two railroad tracks, and 12,000 feet of bridge spans followed by a concrete pile viaduct and a filled causeway. All to have an estimated cost of about $40,000,000 and to be completed in about four years after construction is commenced.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

How to Handle and Erect Girder Spans Without Special Equipment—V*

With ginpoles and moveable derricks.

When derricks, locomotive cranes or other hoisting apparatus are not available, girders of about 10 tons weight may be loaded, unloaded, raised, lowered, shifted a few feet horizontally and erected by the use of the ginpole, which is virtually a guyed mast with a hoisting tackle suspended from it. Girders heavier than 10 tons may be handled by a pair of ordinary ginpoles or by one or two ginpoles of extra strength.

Ordinarily a ginpole consists of any convenient stick of sound timber, 6 inches or more in diameter and 20 feet or more in length with the square lower end seated on an ample timber sill and a hoisting tackle of four parts or more suspended from the top, which is guyed by at least four and preferably by six or eight inclined stays that make the smallest practicable angle with the horizontal and are securely attached to the mast and to their anchorages.

STRENGTH OF LOAD

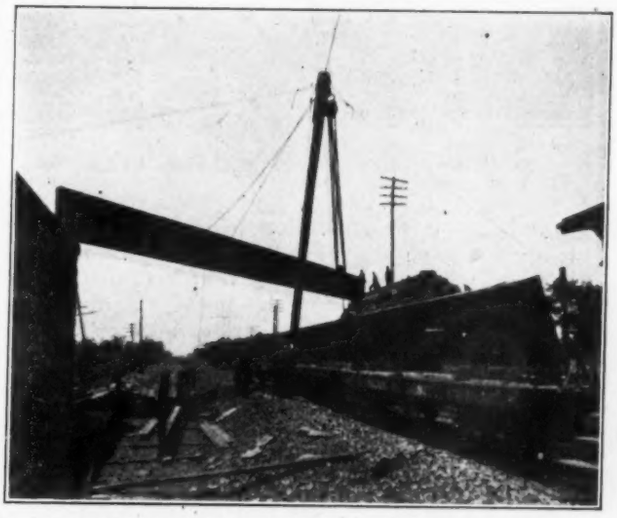
The strength of a ginpole is greatest when the bottom has full even bearing on the horizontal surface and least when it is rounded or takes bearing only at a single point. It is greatest for well seasoned sound timber and may be greatly reduced if the timber is green and has imperfections which may be hidden. Ordinarily if the load is at all heavy in proportion to the nominal strength of the ginpole, it should be lifted cautiously and in all cases the ginpole should be carefully watched to see that it shows no signs of distortion, displacement or failure. Care should always be taken not to pass under the load.

The nominal safe load for square, sound, well seasoned yellow pine ginpoles for a 6 x 6-inch cross section, 14 feet long, is about 4 tons; for 8 x 8-inch cross section, 20 feet long, about 7 tons; for a 10 x 10-inch, 20 feet long, 14 tons. The strength of a ginpole decreases rapidly as the length increases, so that a 10 x 10-inch ginpole, 35 feet high should not be loaded more than 4 or 5 tons at the most, while a 12 x 12-inch ginpole should not be loaded with more than 7 tons for a length of 35 feet or 5 tons for a length of 50 feet.

SPECIAL GINPOLES AND RIGGING

If it is necessary to load a ginpole above a safe amount, the pole can be strengthened by reinforcing the center portions with planks or timbers clamped to it, or by hog trussing it on all sides. Ginpoles of great strength can be made with four full-length square pieces from 4 x 4-inch up to any convenient cross section, placed at the corners of a rectangular from 1 to 4 feet square, and connected by cross pieces and lattice bracing thoroughly bolted on. In making such a compound ginpole, it may be convenient to bend the corner pieces so that they converge toward each other at both ends where they should be enclosed with steel hoops or collars so that they will unite solidly together.

For a small ginpole, manila rope guys secured to the top with proper hitches that cannot slip may be used. For larger jobs the tops should



GINPOLE ERECTING LONG SKEW PLATE GIRDER SPAN

be provided with a sectional steel collar bolted together through flanges to which are connected rings or clevises to receive wire rope guys.

The lower ends of each guy should be securely attached to a tree, stump, heavy masonry or some other object that will anchor it securely against the full weight handled by the ginpole. If no

*Part I.—Transportation to site and erecting by steam protrusion was published July 3.
Part II.—Erection by cribbing, jacking, rolling and skidding was published July 30.
Part III.—With fixed and moveable derricks was published August 6.
Part IV.—With locomotive cranes, derrick cars and wrecking cars was published ? ? ?

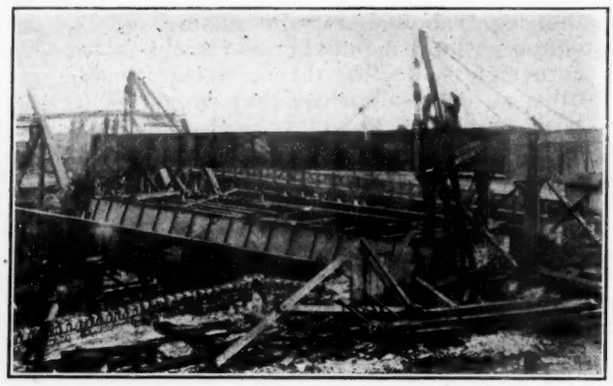
anchorage is available, one can be provided by attaching the end of the guy to a horizontal timber 6 feet or more in length that takes bearing against vertical posts that form part of a heavily loaded platform, or that is buried several feet deep in a trench excavated for the purpose. The guys should be connected to their anchorages with small tackles that allow them to be slacked off or tightened safely under heavy stress.

If no hoisting engine is available, the tackle suspended from the ginpole is usually operated by a hand windlass or crab bolted to the ginpole just above the foot and manned by two or four laborers. When one ginpole is inadequate, two may be used, one near each end of the girder.

When two ginpoles are used for handling a single girder considerable elasticity of arrangement and operation is possible and under certain conditions both ginpoles may be placed on the same side of the girder, or one may be on each side; they may be located symmetrically or at different distances from the center of gravity of the girder and may thus be forced to take equal or unequal portions of its weight.

INSTALLATION OF GINPOLES

The guys, hoisting tackle, and the windlass or crab, if there is one, should be attached to the ginpole while it is in a horizontal position on the



ERECTING LONG PLATE GIRDER WITH TWO GINPOLES

ground. If it is a small pole the top can then be lifted by hand, the bottom securely held in place and the pole gradually revolved to its vertical by men hauling on the guys. Longer and heavier ginpoles can be raised to an angle of 20 or 30 degrees by a light tackle suspended from a sheer leg and attached to the ginpole just above the center of gravity, thus elevating it to an inclination at which it can be revolved to vertical by pulling on the guy lines, which may be operated by tackles or by the windlass. In any event attendants must be stationed at all of the guys, slacking off on the front guys, but keeping them under control to act as preventors and not allow the ginpole to revolve backward or sideways from the vertical.

After the ginpole has been plumbed, the backstays should be slacked off slightly so as to move the top of the pole a foot or two toward the load so that it overhangs it slightly, swinging the hoisting tackle clear of the pole when it hangs free. After the load is hoisted, the guys may be slacked off and taken up so as to swing the load a short distance horizontally away from the ginpole, but the latter should never be allowed to become more than 1 in 12 out of plumb, and very great care should be taken to command the guys in a way that will make it impossible for them to slip.

SHIFTING LOAD ON GINPOLE

If the girder is secured at the bottom of its piers or abutments it may be unloaded parallel to them and hoisted in that position by the ginpoles set between the abutments, and after hoisting to the required elevation the girder may be revolved horizontally while suspended from the ginpole so that its ends are above the masonry bridge seat, to which it can be lowered in a single operation, or it may be lowered to greased rails or other skids on top of the piers or abutments and pushed transversely to the required position, then raised again and lowered to its final seat.

With care a ginpole can be moved a considerable distance horizontally without lowering it to the ground. For this purpose connections should be provided near the bottom for horizontal bars by which the ginpole can be lifted by two or more men on each bar orb y jacking and a plank inserted under it on which the foot of the ginpoles is pushed along with pinchbars.

A man must be stationed at the foot of each guy hauling in those in front and carefully securing the slack and easing off on those behind so as to always keep the pole nearly vertical with the top overhanging slightly in the direction in which it is moved. The bottom should never be placed on rollers.

BREAST DERRICKS, A-FRAMES AND TRIPODS

A breast derrick or an A-frame may be substituted in many places for a ginpole, especially if there is considerable light work to be done and it has to be moved frequently. The A-frame simply consists of two inclined posts, securely fastened together at the top and having their lower ends seated on and firmly attached to a sill. The inclined posts are usually braced together intermediately and a hand windlass or crab attached to the bracing near the foot. Guys are attached to the top of the A-frame, at least two of which must be for backstays, and one in front; four or six guys are required for heavy work. The A-frame should slightly overhang the load so as to allow the hoisting tackle to fall free; it has a greater lifting capacity than a single ginpole of similar dimensions, is much more easily moved, and has greater stability.

For lifting very heavy loads that do not require to be shifted much transversely three poles of convenient size and length may be lashed or bolted securely together at the top, directly over the center of gravity of the load, and the feet of the poles securely seated at the vertices of an equilateral triangle, one side of which is preferably parallel to the girder, which should pass through the center of gravity of the triangle.

The Port of New York District

The recent creation of the Port of New York, including the city of New York and the industrial district in the northern part of New Jersey in a single unit covered by the Port of New York Authority provided by a compact between the states of New York and New Jersey and unanimously endorsed by vote of congress, is a very important factor for the best and most rapid development of commercial and industrial interests that affect not only the business and prosperity of the great metropolitan center, but include more than half of the total foreign commerce of the United States, that amount passing through the port of New York alone.

The district with its population of 8,000,000, its vast liquid and invested capital, and enormous commercial, industrial and transportation interests has almost unlimited resources and opportunities dependent upon very unbalanced conditions due to the tremendous congestion in some portions of the territory that are offset by the potential opportunities for development of large areas of unoccupied land and waterfront capable of being developed under broad and well-digested plans for a co-ordination of great business that without question might exceed in value and importance that of any other center in the world, and that would demand and justify many millions of dollars' worth of construction a year.

In the fiscal year ending August 1, 1914, the last normal year before the war, 76,000,000 tons of freight moved through the port by rail and 45,000,000 tons by water. A substantial percentage of this consisted of perishable foodstuffs, which had to be delivered promptly.

There has never yet been perfected any intelligent, comprehensive plan for receiving and distributing this tremendous tonnage. Of the 76,000,000 tons of freight which moved through the port by rail in 1914, 53,359,000 tons were for local use. Taking the average tonnage of a freight car, this tonnage for local consumption used 3,000,000 freight cars, or 25,000 miles of freight cars.

It is estimated that 45,000,000 tons of freight, enough to fill a line of freight cars reaching halfway around the world, entered or left the port of New York by water in 1914, exclusive of Hudson river and Sound vessels. Eight thousand four hundred vessels, with a capacity of 24,000,000 net tons—a ton being a unit of 100 cubic feet—cleared from the port of New York in 1914.

Although New York handles over 50 per cent of the foreign commerce of the United States, less than 3 per cent of all federal appropriations for rivers and harbors have been expended in New York river and harbor development.

The port of New York, with its three entrances, 800 miles of waterfront, 12 railroads, exclusive of local transit lines, entering the port, a terminus for nearly all of the more important transatlantic lines, not only concerns the people of the two states, but constitutes an asset of the entire nation. The necessity of creating the port district and authorizing the creation of the port authority is manifest from the fact that over forty municipalities are involved, some of them controlled by men of divergent views and many of whom have been working at cross-purposes and in the dark.

Canals in Great Britain

The use of canals and navigable rivers for the transportation of fuel and other bulky freight has been much more developed in Great Britain than in this country and has effected so much economy and improvement of transportation that considerable concern has been felt on account of the gradual absorption of the canals by the railways. In 1909 the total number of miles of canals and navigable rivers in use in the United Kingdom was 4,670. The natural center of the British canal system is the city of Birmingham, where in a 30-mile square the Birmingham canal navigation system has 159 miles of artificial waterways and 212 locks, and supplies 180 plants and manufacturers with fuel. From Birmingham the main canal routes include 147 miles and 166 locks to London; 140 miles with 101 locks to Liverpool; 162 miles with 66 locks to Hull and to Sharpness, one route of 75½ miles with 61 locks and an alternative of 89 miles with 49 locks.

Unfortunately the dimensions and capacity of the locks vary so that the traffic is limited at different places to vessels from about 70 feet long and 6 feet 9 inches wide, to a maximum of 145 feet long and 22 feet wide, the depth of the canals in some places averaging only about 3½ feet long and 22 feet wide, the depth of the capacity from 28 tons to 1,200 tons for the different sized boats at different portions of the system about one-third of which is limited to the smallest size boat mentioned.

According to American canal standards the dimensions of these canals would rank them little above feeders, but a realization of the benefits derived from such an imperfect system should make for more careful consideration of the improvements of our rivers and the establishment of locks and connections that would enable slow freight to be transported in vastly greater quantities on our inland waterways.

A Suspended Dump Track

The upstream and downstream toes of the earth dam across the Miami river at Taylorsville have been built by the Roberts Brothers, Chicago, for the Miami Conservancy District.

The spoil used for making the toe embankments was delivered in side-dump cars, pushed by the locomotive on a track laid on top of the embankment and continued beyond it on a suspension bridge having four 1¼-inch Hercules red strand wires ropes, 502 feet long, made by the Leschen & Sons Rope Co., St. Louis. The ropes were symmetrically arranged one foot six inches from the center line, and supported track ties 2 feet apart bolted to the outer cables. Each cable was equipped with a special bridge socket and take-up for the required adjustment which did not exceed 15 inches. The equipment was in use for about one month, after which the cables, which were in good condition, were used for swinging cables on steam shovels.

DISCRETION OF MUNICIPALITY OWNING WATER WORKS TO DETERMINE WHAT EXTENSIONS WILL BE MADE

The Wisconsin Railroad Commission is of opinion that a municipally owned utility should exercise a somewhat wider discretion in determining the conditions under which extensions will be built than a privately owned utility, inasmuch as the former is presumably under the control of and representative of the public. The rules for future extensions filed with the commission for the municipal water plant at Fond du Lac contain the following provisions: "The water department will lay water mains wherever needed as rapidly as funds are available, for such extensions. The department, however, reserves the right to determine when such extensions will be made, and upon what terms or under what arrangements with applicants the work shall be authorized and carried to completion. The interests of the taxpayers and the consumers of service must be considered in connection with applications for extensions and the department cannot be expected to order such extensions unless public policy or the prospective income from the consumers taking service from the new main will justify the expenditure."

A UTILITY LEASED TO A PRIVATE COMPANY IS MUNICIPALLY OWNED AS REGARDS THE COMMISSION'S JURISDICTION

The Illinois Public Utilities Commission, denying its jurisdiction to pass upon the rates for electric service proposed by the Louisville Light & Water Company, holds that a public utility which is leased by a municipality to a private company is municipally owned, so far as the jurisdiction of the commission is concerned, and the commission has no jurisdiction over the rates for service furnished by a municipally owned plant.

ACCEPTANCE OF STREET PRESUPPOSES OPTION IN MUNICIPALITY

The Alabama Supreme Court holds, Town of Clanton v. Chilton County, 87 So. 345, that where a county without authority used road and bridge funds for the improvement of a street, the town was not liable on an implied contract on the theory of acceptance merely because the street was used by its residents, since acceptance presupposes an option or choice to reject or accept, and neither the municipality nor its citizens could be held to the consequences of an acceptance because the street, in its improved state, was not abandoned.

CITY'S POWER TO PURCHASE ELECTRIC ENERGY

In a broad analysis of the term it can hardly be disputed that electrical energy as manufactured and supplied for public and private use is property. Electricity is rather an intangible asset, and the word "property" is perhaps not the most apt word by which to describe the supply of electrical energy thus sought to be acquired for the use of the city. However, if it was a water supply to be delivered from without to the mains of the city's distributing system, it might appropriately be so described, and an electric current to be delivered at the main conduit of the city's electrical distributing system is not essentially different. Therefore the California Supreme Court holds, Miller v. Los Angeles, 197 Pac. 342, that a provision in the city charter, empowering it to acquire, by purchase or otherwise, all property necessary or convenient to furnish the city and its inhabitants with light, heat and power, even if such provision is to be strictly construed, authorizes the city to make a contract for the purchase of electric energy sufficient to supply its inhabitants, even though the energy is not, strictly speaking, property.

CITY'S RIGHT TO DETERMINE PRICE OF IMPROVEMENT

If a city council and a board of supervisors may determine what improvements are calculated to advance the public interest, subject to interference by the courts only, when it is plainly apparent that such improvements are not so calculated, it must necessarily be true that they may determine what price shall be paid for these improvements, subject to no greater right in the courts to interfere. Los Angeles County v. Dodge (Cal. App.), 197 Pac. 403.

EFFECT OF NOTICE TO CITY BY PARTNER NOT TO DELIVER WARRANT TO OTHER PARTNER

The Pennsylvania Supreme Court holds, Markee v. City of Philadelphia, 113 Atl. 359, that where two partners of a firm which had a sewer construction contract with the city each notified the city not to deliver a warrant for money earned under the contract to the other partner, and the city withheld the warrant, the partners and the firm were estopped to claim that the city could have safely delivered the warrant to either partner, and they could not recover from the city damages caused by their failure to complete the work for lack of money. The city had nothing to do with the disputes of the partners, and was not obliged to decide between them, and by paying to one possibly become a litigant with the other.

EFFECT OF FAILURE TO APPEAL FROM DISALLOWANCE OF CLAIM FOR DAMAGES FOR ESTABLISHMENT OF ROAD

Where a road is established by a board of county commissioners, and a landowner presents a claim for damages because of the establishment of the road, which is not allowed, and no appeal is taken by him from the order, his right to claim damages is then ended, and the board of county commissioners is without authority thereafter to allow his claim of damages.—Zahn v. Board of County Commissioners, Kansas Supreme Court, 196 Pac. 1060.

NEWS OF THE SOCIETIES

August 29-30—INDIANA BUILDING TRADES COUNCIL, Hammond, Ind. Henry Gabler, Secretary, 436 Sumner st., Hammond, Ind.

Aug. 30-Sept. 1—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting. Flint. Mich.

Sept. 2-3—MONTANA ASSOCIATION OF ARCHITECTS. Billings, Mont.

Sept. 6-10—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Colorado Springs, Colo. Secretary, C. R. George, Houston, Texas.

Sept. 12-17—NATIONAL ASSOCIATION OF SANITARY ENGINEERS. Evansville, Ind.

Sept. 12-26 — AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS. Wilkesbarre, Pa.

Sept. 13-16—NEW ENGLAND WATER WORKS ASSOCIATION. 39th annual convention. Bridgeport, Conn. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 14-15—ASSOCIATED BUILDING CONTRACTORS OF ILLINOIS. Semi-annual meeting. Danville, Ill.

Sept. 19-21—ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA. Chicago, Ill. Secretary, P. J. McAndrews, C. & N. W. Ry., Sterling, Ill.

Sept. 19-23—INTERNATIONAL ASSOCIATION OF INDUSTRIAL ACCIDENT BOARDS AND COMMISSIONER. Chicago. Secretary, Ethelbert Stewart, U. S. Bureau of Labor Statistics, Washington, D. C.

September 19-24 — ASSOCIATION OF IRON AND STEEL ENGINEERS, La Salle Hotel, Chicago, Ill.

Sept. 26-30—ILLUMINATING ENGINEERING SOCIETY. Rochester, N. Y, Illuminating Engineering Society, Chicago Section, Chicago with National.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

October—IOWA SECTION OF THE AMERICAN WATER WORKS ASSOCIATION. Seventth annual meeting, Omaha, Neb. Secretary, Jack J. Hinman, Jr., State University, Iowa City, Ia.

Oct. 5-7—SOCIETY OF INDUSTRIAL ENGINEERS. National convention. Springfield, Mass.

Oct. 1-15—LYONS FAIR FOR PROMOTION OF INTERNATIONAL TRADE. Lyons, France.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

AMERICAN ASSOCIATION OF ENGINEERS

A meeting of representatives of eight Indiana chapters of the American Association of Engineers for the purpose of organizing a state assembly or Indiana branch of the national organization has been called for August 29 by R. C. Yeoman, chairman of the state assembly committee of the American Association. Mr. Yeoman has requested the chapters of the association at Gary, Logansport, South Bend, Terre Haute, Valparaiso, Purdue and Angola as well as the local chapter, to send representatives to the meeting.

It is expected that the organization of the state assembly will include the establishment of permanent offices of the state association in Indianapolis in the charge of a paid secretary. It is possible that the state offices of other organizations of technical men may occupy the same general headquarters. The association has 700 members in Indiana.

CONFERENCE OF STREET CLEANING OFFICIALS

The International Association of Street Cleaning Officials held its second annual conference August 10, 11 and 12 in Chicago. The program announced included:

Possibility of establishing I. A. S. C. O. uniform cost-keeping form.

Garbage, ash and rubbish collection. a. Fly extermination. b. Savannah's incinerator experience. c. Disposal: 1. Hog feeding. 2. Incinerator. 3. Reduction plant. d. Contract or municipal. e. Receptacles. f. Equipment used. g. Frequency of service. h. Separation.

How are complaints handled? a. Plans used in subdividing work.

Sewer and catch-basin cleaning. a Removal of roots from sewers. b. Huntington's experience with Victor self-propelling nozzles.

Snow removal. a. Chicago's experience in snow removal work.

Street cleaning. a. Flushing. 1. Automobile, double or single unit. 2. Horse-drawn. 3. Hand-hose. b. Sprinkling. c. Hand brooming. d. Machine sweeping. 1. Sand spreading in connection therewith. e. Disposal of street sweepings. f. Personnel. 1. Wages—will there be a reduction? 2. Uniforms.

MICHIGAN BOARD OF EXAMINERS

The Michigan State Board of Examiners will meet for the registration of engineers, architects and surveyors at University of Michigan, Ann Arbor, September 14-16, for blanks and full information address Room 420 North 508 Griswold street, Detroit, Mich.

SOUTH CAROLINA GOOD ROADS ASSOCIATION

This association was recently organized at Columbia, S. C., for the purpose of "pulling the state out of the mud." A publicity and educational campaign is proposed to create a popular demand for good roads.

INTERNATIONAL ASSOCIATION OF INDUSTRIAL ACCIDENT BOARDS AND COMMISSIONS

The eighth annual meeting of the International Association of Industrial Accident Boards and Commissions will be held at the La Salle Hotel, Chicago, on September 19-23. The program will open on Monday morning when the president will deliver his annual address, Henry D. Sayer will talk on "Administrative Reorganization and New Methods in New York," and discussions will be heard on new legislation in several states. On Monday afternoon the addresses of welcome will be delivered at one session, and at another held at the same time the topic will be "Admin-

The municipal auditorium at Santa Monica, Cal., is nearly completed for the use of the municipal convention to be held there September 27-30, arrangements for the municipal expositions are in charge of W. H. Parker, commissioner of public works, Santa Monica.

PERSONALS

Becker, William C. E., has been appointed chief engineer of the Department of Public Safety of St. Louis.

Grant, J. A., is now engaged in hydraulic design work on the reconstruction of works in Pueblo, Colo.

Lippe, Ernest V., consulting mechanical engineer, has established an office at 108 South La Salle street, Chicago, where he will continue his engineering practice.

Keith, Grover, mechanical engineer with the Victor Chemical Works, Chicago Heights, Ill., has resigned to accept a position with the United States Gypsum Co.

Quinney, Elwin, is now resident engineer with the South Dakota State Highway Commission in charge of the construction of state and federal aid roads in Deuel and Codington counties. His headquarters are at Watertown.

Mosher, Edward, has been appointed town engineer, Westfield, N. J., and will have charge of the construction and maintenance of roads and sewers and the operation of sewage disposal works.

Samms, Virgil W., has been appointed surveyor-general of the state of Idaho.

Crocker, Herbert S., has opened an office in Denver, Colo., where he will specialize in design and superintendence of construction of bridges, foundations, buildings and public utilities.

Sours, E. E., has been appointed road engineer for Allegan county, Mich.

Stone, Dr. W. E., president of Purdue University, Lafayette, Ind., was killed on Mount Eon, Alberta, Canada, on July 27, when he was trying to rescue his wife from a ledge on which she had fallen.

Logan, W. L., Council Bluffs, Ia., was drowned in the Missouri river July 1.

Hewes, Charles E., has accepted a position as city manager of Long Beach, Cal.

Hewes, Charles E., has resigned his position as city manager of Alameda, Cal.

Ewart, David, for many years chief architect of the Federal Public Works Department, died at Ottawa on June 7 at the age of 80.

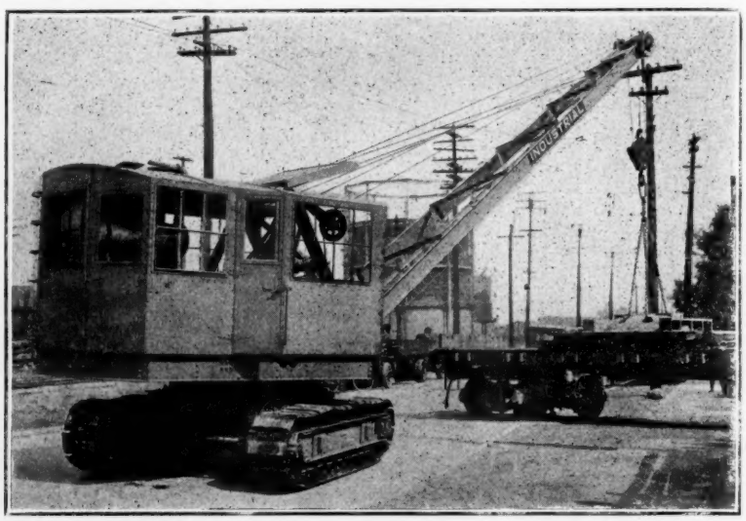
New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

FULL REVOLVING INDUSTRIAL CRAWLING TRACTOR CRANE

The Type BC "Industrial" crawling tractor crane, manufactured by the Industrial Works, has been developed to meet the need for a full-revolving tractor crane which can be operated independently of rails. The crane is built in two types. Type BC with a capacity of 20,000 pounds at 12 feet radius is equipped with continuous crawling tractor belts. Type BT with a capacity of 18,000 pounds at 10 feet radius is equipped with four broad-gauge tractor wheels.

These cranes, backed by half a century of crane building success, are pre-eminently adapted to the needs of contractors, road builders, gravel, sand and stone producers, and others. The capacity and speed of these cranes make them ideally suited for doing such jobs as moving coal, sand, gravel, etc., and for excavating duty. Within the limits of their capacity they will serve with the same efficiency as the railroad crane.



INDUSTRIAL CRAWLING TRACTOR REVOLVING CRANE

They can be equipped to handle a hook and block, grab bucket, drag scraper bucket, wood grapple, electric lifting magnet, shovel dipper and pile driver leads with drophammer.

Operation is by means of an internal combustion engine which has the advantages of being always ready for immediate use. When not in operation no fuel is consumed and it is not necessary, as often with a steam operated machine, to have a licensed engineer as operator.

The utmost care has been used to combine the necessary strength with the light weight essential to a tractor crane. Convenience in operation and maintenance have been provided to the highest possible degree.

The crane is equipped with 30-foot structural steel boom. The steering is accurately controlled by the operator from his position in the revolving upperworks, by manipulation of the friction clutches and brakes for each tractor belt. By means of which either tractor belt can be instantly disconnected from the motor while the other belt continues traveling at the normal rate of speed.

The disconnected tractor belt can be held stationary by applying the brake, can be allowed to coast with the brake and clutch both disengaged, or the clutch can be allowed to slip, thus allowing operator to turn as sharp or as wide a corner as he may select. All the clutches, brakes and lever mechanism for steering are located in the revolving upper works where the mechanism is simpler and more accessible than when a portion or all of it is located on the car body.

The propelling and steering mechanism is a new and exclusive feature of this crawling tractor crane. It enables the operator to propel and steer the crane, independently of all other motions, as easily as a wheel or "caterpillar" tractor.

WEBB CITY PORTABLE CRUSHING OUTFITS

The stone crushing outfit, made by the Webb City & Carterville Foundry & Machinery Works, has an all-steel stone crusher with a capacity of 6 tons per hour of stone crushed to 2-inch size, mounted on a steel truck that is also equipped with a folding bucket elevator that can be collapsed by a worm and chain gear to fold back over the top of the crusher and reduce it to sufficient clearance for highway transportation. The feeding platform is only 48 inches above the ground. The machine is easily fed and is adjusted by a well-protected hand wheel. The approximate horsepower that is required for the different sizes of machine are 12, 14 and 16 and the crusher can be equipped with portable screens and bins that make it complete and convenient for road construction operations.

THE MICHIGAN, JR., GRAVEL SCREENER AND LOADER

A machine that will take the gravel out of the pit or pile, screen out the sand and stones, and load the gravel into wagons or trucks.

It runs, by its own locomotive gear, up and down the side of the pit or pile on a track and takes off a 4-foot slice each time. It is self-contained and has an attachment on the screen that prevents it from clogging up with clay, clods, etc.

The loader delivers the screened gravel next to the machine, and the sand and stones separately twenty feet away where they will not have to be moved, thus saving $20 to $30 expense per day.

It is of simple all steel construction. Under ordinary conditions, three men operate it. It has an elevating capacity of one yard per minute.

INDUSTRIAL NOTES

The Canadian Chicago Bridge & Iron Company, Limited, of Bridgeburg, Ont., and Montreal, Quebec, has changed its corporate name to Horton Steel Works in honor of the late Horace E. Horton, who founded the organization in the United States in 1865. The Canadian organization was first incorporated in 1913 and the plant at Bridgeburg, Ontario, was constructed in that year.

THE RANSOME CONCRETE - MACHINERY CO.

The Ransome Concrete Machinery Co. has recently shipped the third 21-E paver to the Tri-State Construction Co. at Bridgeton, N. J., who will soon have all of them in daily operation on one large job. The Ransome factory at Dunellen, N. J., is working constantly on these 21-E pavers and to date has not been able to get ahead of the orders.

The Ransome Co. has brought out this year a new 10-E Bantam type paver, and are shipping one this week to the city of Chicago. This type paver is particularly attractive for municipal work.

The New Orleans office of the Southern Cypress Manufacturers' Association is now located in the Poydras building, 507 Carondelet street, New Orleans.

The Consolidated Expanded Metal Company, Braddock, Pa., has established a new office and warehouse carrying a complete stock at 537 West 35th street, New York City, in charge of Thomas R. Herbert, Jr.

Yeomans Brothers Co., 1433 Dayton street, Chicago, manufacturers of centrifugal sewage ejectors, Shone pneumatic sewage ejectors and drainage pumps, announces the following representatives: P. E. Fallon, Gazette building, Little Rock, Ark., and Morton McI. Duekart & Co., McComas and Race streets, Baltimore, Md.